## Desal DA

### 1NC – Desal

#### Nuclear power is key to stable desalinization – demand is high and rising

IAEA 15 [-- widely known as the world's "Atoms for Peace" organization within the United Nations family. Set up in 1957 as the world's centre for cooperation in the nuclear field, the Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies, “New Technologies for Seawater Desalination Using Nuclear Energy,” IEAE TecDoc Series, 2015]

It is anticipated that by 2025, 33% of the world population, or more than 1.8 billion people, will live in countries or regions without adequate supplies of water unless new desalination plants become operational. In many areas, the rate of water usage already exceeds the rate of replenishment. Nuclear reactors have already been used for desalination on relatively small-scale projects. In total, more than 150 reactor-years of operating experience with nuclear desalination has been accumulated worldwide. Eight nuclear reactors coupled to desalination projects are currently in operation in Japan. India commissioned the ND demonstration project in the year 2008 and the plant has been in continuous operation supplying demineralised (DM) quality water to the nuclear power plant and potable quality to the reservoir. Pakistan has launched a similar project in 2010. However, the great majority of the more than 7500 desalination plants in operation worldwide today use fossil fuels with the attendant emission of carbon dioxide and other GHG. Increasing the use of fossil fuels for energy-intensive processes such as large-scale desalination plants is not a sustainable long-term option in view of the associated environmental impacts. Thus, the main energy sources for future desalination are nuclear power reactors and renewable energy sources such as solar, hydro, or wind, but only nuclear reactors are capable of delivering the copious quantities of energy required for large-scale desalination projects. Algeria is participating in an IAEA’s CRP in the subject related to “New technologies for seawater desalination using nuclear energy’’ with a project entitled “Optimization of coupling nuclear reactors and desalination systems for an Algerian site Skikda”. This project is a contribution to the IAEA CRP to enrich the economic data corresponding to the choice of technical and economical options for coupling nuclear reactors and desalination systems for specific sites in the Mediterranean region

#### Only solution to water shortages

IAEA 15 [-- widely known as the world's "Atoms for Peace" organization within the United Nations family. Set up in 1957 as the world's centre for cooperation in the nuclear field, the Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies, “New Technologies for Seawater Desalination Using Nuclear Energy,” IEAE TecDoc Series, 2015]

Addressing water shortages is a difficult challenge for many countries due to population growth and the increasing need for water to support industry, agriculture and urban development. Innovative water management strategies are certainly needed to preserve water resources. But they may not be sufficient. Throughout the world, many highly populated regions face frequent and prolonged droughts. In these areas, where, for some reason, the natural hydrologic cycle cannot provide people with water, desalination is used to provide people with potable water. Desalination systems fall into two main design categories, namely thermal and membrane types. Thermal designs –including MSF and MED- use flashing and evaporation to produce potable water while membrane designs use the method of RO. Desalination is the main technology being used to augment fresh water resources in water scarce coastal regions. With almost 64.4 million m3 /day (GWI 2012) of worldwide desalination water production capacity, about two third is produced by thermal distillation, mainly in the Middle East. Outside this region, membrane-based systems predominate. Both processes are energy-intensive (Fig. I-1.). Even if power consumption has been reduced as technological innovations, such as energy recovery systems and variable frequency pumps (reverse RO plants), are introduced, it remains the main cost factor in water desalination. Traditionally, fossil fuels such as oil and gas have been the major energy sources. However, fuel price hikes and volatility as well as concerns about long term supplies and environmental release is prompting consideration of alternative energy sources for seawater desalination, such as nuclear desalination and the use of renewable energy sources. Replacing fossil fuel by renewable (solar, wind, geothermal, biomass) or nuclear energy, could reduce the impacts on air quality and climate. FIG. I-1. Typical energy consumption of technologically mature desalination processes. The idea of using nuclear energy to desalinate seawater is not new. Since the USS nautilus was commissioned more than a half century ago, the drinking water on nuclear submarines has come from reactor-powered desalination systems. Today, nuclear desalination is being 106 used by a number of countries, including India and Japan, to provide fresh water for growing populations and irrigation. Commercial uses are also being considered in Europe, the Middle East and South America. The IAEA has always been an important contributor to the R&D effort in nuclear desalination. In 2009, it launched a coordinated research programme entitled “New Technologies for Seawater Desalination using Nuclear Energy”, focusing on the introduction of innovative nuclear desalination technologies, producing desalted water at the lowest possible cost and in a sustainable manner. The French atomic and alternative energies commission (CEA) expressed interest in participating to the CRP. A research proposal, aiming at using CEA software tools to develop optimized nuclear desalination systems was established and submitted to the IAEA. The studies focused on the development of optimized nuclear desalination systems producing large amounts of desalinated water while minimizing the impact on the efficiency of power conversion. Technologically mature desalination processes viz. MEE and RO have been considered for the study. Each of these systems will be modelled using innovative techniques developed in CEA. Models would first be validated (against experimental results published in literature, or obtained through bilateral collaborations involving CEA) and then applied to optimize the energy use in the integrated power and water plants.

#### Water crises cause escalating global conflict

Rasmussen 11 [(Erik, CEO, Monday Morning; Founder, Green Growth Leaders) “Prepare for the Next Conflict: Water Wars” HuffPo 4/12] AT

For years experts have set out warnings of how the earth will be affected by the water crises, with millions dying and increasing conflicts over dwindling resources. They have proclaimed -- in line with the report from the US Senate -- that the water scarcity is a security issue, and that it will yield political stress with a risk of international water wars. This has been reflected in the oft-repeated observation that water will likely replace oil as a future cause of war between nations. Today the first glimpses of the coming water wars are emerging. Many countries in the Middle East, Africa, Central and South Asia -- e.g. Afghanistan, Pakistan, China, Kenya, Egypt, and India -- are already feeling the direct consequences of the water scarcity -- with the competition for water leading to social unrest, conflict and migration. This month the escalating concerns about the possibility of water wars triggered calls by Zafar Adeel, chair of UN-Water, for the UN to promote "hydro-diplomacy" in the Middle East and North Africa in order to avoid or at least manage emerging tensions over access to water. The gloomy outlook of our global fresh water resources points in the direction that the current conflicts and instability in these countries are only glimpses of the water wars expected to unfold in the future. Thus we need to address the water crisis that can quickly escalate and become a great humanitarian crisis and also a global safety problem. A revolution The current effort is nowhere near what is needed to deal with the water-challenge -- the world community has yet to find the solutions. Even though the 'water issue' is moving further up the agenda all over the globe: the US foreign assistance is investing massively in activities that promote water security, the European Commission is planning to present a "Blueprint for Safeguarding Europe's Water" in 2012 and the Chinese government plans to spend $600 billion over the next 10 years on measures to ensure adequate water supplies for the country. But it is not enough. The situation requires a response that goes far beyond regional and national initiatives -- we need a global water plan. With the current state of affairs, correcting measures still can be taken to avoid the crisis to be worsening. But it demands that we act now. We need a new way of thinking about water. We need to stop depleting our water resources, and urge water conservation on a global scale. This calls for a global awareness that water is a very scarce and valuable natural resource and that we need to initiate fundamental technological and management changes, and combine this with international solidarity and cooperation. In 2009, The International Water Management Institute called for a blue revolution as the only way to move forward: "We will need nothing less than a 'Blue Revolution', if we are to achieve food security and avert a serious water crisis in the future" said Dr. Colin Chartres, Director General of the International Water Management Institute. This meaning that we need ensure "more crop per drop": while many developing countries use precious water to grow 1 ton of rice per hectare, other countries produce 5 tons per hectare under similar social and water conditions, but with better technology and management. Thus, if we behave intelligently, and collaborate between neighbors, between neighboring countries, between North and South, and in the global trading system, we shall not 'run out of water'. If we do not, and "business as usual" prevails, then water wars will accelerate.

### Link – Africa

#### Africa needs nuclear desal

Mabuza 10 [Sibusiso Mabuza, (Ph.D. student in Mathematics at The University of Houston), "SECURING AFRICA’S WATER SUPPLY THROUGH NUCLEAR DESALINATION," 6/7/2010] AZ

The human can only survive by changing nature. As science and technology advances rapidly to higher levels, we get answers to the most complex of problems in life. One of these complex issues, currently facing Southern Africa and indeed other parts of Africa is the shortage of clean fresh water. In Swaziland for instance, the question has come up on several occasions on how a reliable source of fresh clean water can be obtained, especially in the drought stricken lowveld region where boreholes are an absolute necessity. The question is, how can the persistent drought that has brought about harsh realities to the rural subsistence farmer in the Ngwavuma valley as well as to the sophisticated vineyards of the Western Cape be subdued? Population growth, economic expansion, and increased pollution by mines and industries continue to make it harder and harder to get clean sources of water. This leaves us with no alternative but to seek revolutionary cutting edge solutions. Could Nuclear Desalination be the answer?

We are surrounded by water, well seawater, which is not drinkable. The process of nuclear desalination would use nuclear power to facilitate the reverse osmosis that is a key step of the process. Results were produced by some research conducted saying that desalination through nuclear power can go a long way to producing the much needed freshwater. As reported in the Science Daily, nuclear power could have limited environmental impact since there will be fewer emissions, and the nuclear plants will be sited offshore carrying out desalination as well as producing electricity for communities inland. Comparing this to fossil fuel process employed in places such as Israel, this might prove more advantageous. A scientific/industrial project of this magnitude might seem farfetched for Southern Africa, but it could open new doors in the nuclear tech industry and spur growth in other sectors. Maybe it is about time we take water from the sea to the land instead of the opposite natural process. Maybe it is about time Africans change nature to better suit our ever changing way of life.

### Link – Egypt

#### Nuclear desal there now

GWI 16 [Global Water Intel, "Rosatom looks into nuclear desalination in Egypt," 5/26/2016] AZ

Desalination specialist ILF Consulting Engineers has been taken on by Russia’s Rosatom to look into the feasibility of a major desalination plant on Egypt’s north coast.

The 170,000m3/d facility at Dabaa, 100km west of Alexandria, would be powered by the 4,800MW power facility due to be built by the state-owned nuclear body. Egypt has been keen to expand its desalination base as a response to rising demand for water in the country, combined with ongoing fears about the security of water resources from the Nile.

The Nile has traditionally supplied the vast majority of drinking water in Egypt, but upstream countries have been agitating for changes to the allocation Egypt is entitled to under long-standing regional treaties.

An agreement to build the four-unit Dabaa nuclear power plant was signed by Rosatom and minister of electricity Mohamad Shaker in November last year.

### Link – Russia Deal

#### Russia deals are key to nuclear desal – their removal of nuclear power crushes water creation

Dalton 15 [David Dalton (editor at NucNet), "Russia And Egypt Sign Agreement To Develop Nuclear Desalination Plant," NucNet, 3/3/2015] AZ

Rosatom did not release details of the agreement, but said it believes a desalination facility at a large capacity nuclear power plant with Russian-supplied VVER pressurised water reactors has “significant potential” in foreign markets. Such a facility would be able to produce up to 170,000 cubic metres of fresh water a day from one nuclear power unit, Rosatom said. The only large nuclear facility a water desalination facility operated with heat from the 52-megawatt BN350 fast breeder reactor at Aktau in the former Soviet Union, now Kazakhstan. It delivered more than 100,000 cubic metres of fresh water per day, but was shut down in April 1999 and is being decommissioned. In September 2014, a council established in Russia to develop technological solutions for using nuclear energy in water desalination said it was planning to work with foreign partners on plans to finance and construct a nuclear plant with a desalination facility. Rusatom Overseas, a subsidiary of Rosatom, said its Expert Council on Desalination would deal with tasks aimed at the development of “the best technological solutions” for Rusatom Overseas’ customers in water and water treatment markets. According to the International Atomic Energy Agency, most desalination plants use fossil fuels, contributing to increased greenhouse gas emissions. There are about 15,000 plants producing desalinated water, most in the Middle East and North Africa. The largest is in Saudi Arabia. Argentina, China and South Korea have developed small nuclear reactor designs specifically to generate both electricity and fresh water. Small reactor technology may be key to expanding clean, nuclear energy-based desalination, the IAEA said. In Japan, some of its nuclear stations are equipped with seawater desalination plants to provide high quality make-up water for the boiler feed water as well as for other uses after an appropriate water post treatment. Similarly, in Pakistan, a seawater desalination plant has been set up at the Kanupp nuclear station to meet the normal operational requirements of the plant in addition to providing an independent source of emergency feed water to the steam generator. The IAEA said that for wider deployment of nuclear desalination, additional requirements have to be met under specific conditions. Technical issues include meeting more stringent safety requirements specifically for nuclear-desalination integrated plants and improvement on performance of the integrated systems. Another important factor for consideration in wider deployment of nuclear desalination is economic competitiveness compared with other options such as fossil fuel powered co-generation plants. Rosatom is focusing on multiple-effect distillation (MED) technologies, which consist of multiple stages or “effects”. In each stage, the feedwater is heated by steam in tubes. Some of the water evaporates, and this steam flows into the tubes of the next stage, heating and evaporating more water. Each stage essentially reuses the energy from the previous stage. Rusatom Overseas said about two billion people suffer from lack of fresh water. At the same time, major population growth in the coming decades is expected in the regions that are already affected by shortages of fresh water – Latin America, Africa, the Middle East and southeast Asia. The IAEA, which has been providing technical support to member states interested in using nuclear power for desalination, said nuclear could help bring down costs. A new generation of innovative small and medium nuclear power plants could co-generate electricity and potable water, both safely and at competitive prices, the agency said.

### 2NC – Nuclear Desal Solves

#### Nuclear desalination solves hundreds of inevitable water conflicts globally

White 9 – Commodities Editor for the Telegraph

(Garry, “Can nuclear solve the global water crisis?,” The Telegraph, December 20, 2009, http://www.telegraph.co.uk/finance/newsbysector/energy/6851983/Can-nuclear-solve-the-global-water-crisis.html)//ac

As the global population expands, demand for water for agriculture and personal use will increase dramatically, but there could be a solution that will produce clean drinking water and help reduce carbon emissions as well. That process is nuclear desalination. Many areas of the world are suffering from a water crisis – and it's not just arid, developing countries that are suffering. The Western US is particularly vulnerable and its water crisis is getting more severe by the day. Las Vegas could be one of the first US cities to be hit by a serious water shortage, some are even questioning whether it can survive at all. The city gets 90pc of its water from Lake Mead, the body of water created by the Hoover Dam. The water in Lake Mead, and the Colorado River which feeds it, has been falling for some time. It is slowly running dry due to overuse. The Scripps Institution of Oceanography believes there is a 50pc chance that the lake will be completely dry by 2021 if climate change continues as expected and future water usage is not curtailed. Water is so important that, as a population grows and demand increases, there is a strong chance of conflict in the future. According to the World Water Council, 260 river basins are shared by two or more countries. "In the absence of strong institutions and agreements, changes within a basin can lead to transboundary tensions," the Council said. "When major projects proceed without regional collaboration, they can become a point of conflicts, heightening regional instability." The World Water Council cites the Parana La Plata in South America, the Aral Sea, the Jordan and the Danube as examples. It's not just tensions between countries that are a potential problem. Civil unrest caused by scarcity has already started. In India on December 3, one man was killed and dozens injured during a protest over water rationing in Mumbai following the country's poor Monsoon. The prospect of further water riots is very real. However, nuclear energy could help provide the solution for this thorny issue. Oil-rich Middle Eastern nations are rushing to build new nuclear plants. Anwar Gargash, a foreign affairs minister in the United Arab Emirates (UAE), said last month that nuclear power was "best able" to meet future power demand in his country. Demand for electricity is expected to double by 2020. This followed comments from Saudi Arabia, which said it planned to generate up to a quarter of its electricity from nuclear power within the next 15 years. Everyone thinks the trend for oil-rich nations to move towards nuclear power generation is about limiting domestic consumption so they can boost oil exports. However, that's just part of the story. Saudi Arabia, for example, has very little water – and global warming is likely to make this situation much worse. This is a major problem because Saudi Arabia is about to see its population explode. The overwhelming majority of the Saudi people are young. Almost 40pc of its population is under the age of 14, with just 2.5pc being in the over 65 bracket. This means its population is growing at about 2pc per year – and as the young start to have families of their own, the rate of population growth will increase. In fact, many of the nations that are predicted to have the strongest growth in population over the next years are the areas where the water crisis is most acute. For example, the UAE has the largest growth rate of any nation in the world – at 3.69pc, according to data compiled by the US government. Nuclear reactors can be used to generate electricity – but they can also be used to desalinate water. Nuclear desalination is not a new idea – it's a proven technology, thanks to Kazakhstan. A single nuclear reactor at Aktau on the shore of the Caspian Sea successfully produced up to 135 megawatts of electricity and 80,000 cubic metres of potable water a day between 1972 and 1999, when it was closed at the end of the reactor's life. Water has also been desalinated using nuclear reactors in India and Japan. The problem with desalination is that it is very energy intensive. Most desalination today uses fossil fuels, contributing to carbon emissions. However, because nuclear power generation does not emit carbon, it is a clean and efficient way of producing the most important commodity around. For countries experiencing rapid population growth, it could be a lifesaver.

#### The plan solves global water scarcity- nuclear desalination is key to small operating costs

Boateng et al 11

(Boateng et al. 11’, 8/23/11, Research Paper Submitted to the Research Journal of Applied Sciences, Engineering, and Technology “Performance Analysis of Thermal Vapour Compression Desalination System Coupled to Cogeneration Nuclear Power Plant”, RJASET, http://maxwellsci.com/print/rjaset/v4-941-948.pdf)

The world is becoming increasingly aware of critical limitations in the availability of fresh water for agricultural, industrial and domestic uses. Desalination of seawater has been identified a viable approach to solving the problem of water shortages but energy unavailability presents another problem area. Desalination is the production of fresh water from saline water. Therefore, there is the need for research to be conducted into alternative energy sources aside the convectional fossil energy for producing fresh water and nuclear desalination is one such technology that has higher prospects (Kalogiru, 1997). The desalination of seawater using nuclear energy form cogeneration nuclear power plants is a feasible option to meeting the growing demand for potable water. This has been motivated by a wide variety of reasons, ranging from economic competitiveness of nuclear energy to energy supply diversification and to the spin-off effects of nuclear technology in industrial development (Misra and Kuptz, 2004) The high cost of energy usually results in high product cost of desalted water and desalination systems must be designed to ensure the most economic use of energy and other resources. Technological efforts must concentrate on reducing the capital, operation, maintenance, and above all, the energy costs. Technological improvements in plant design, heat-transfer technology, corrosion protection, and chemical selection will lead to extended life spans and reduced operation and maintenance costs of desalination units. Consequently, desalination plant must meet high standards of performance, including optimality, cost effectiveness, reliability, and safety. These can be achieved by using modeling and modern computer-based simulation techniques. Therefore, the need to design and develop efficient and cost effective nuclear desalination technologies with small to medium scale capacities to meet the needs of hard pressed economies of the world that need desalination of saline water remain more paramount (Homig, 1978).

#### **Nuclear powered desalination is the safest and must sustainable energy source.**

Khamis et al ’13, International Atomic Energy Agency, ( K.C. Kavvadias, “Nuclear desalination: Practical measures to prevent pathways of contamination,” Desalination Volume 321, Science Direct, <http://dl2af5jf3e.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF>) FT

Today, there is a global concern on climate change and water scarcity issues. Both issues could well be alleviated using desalination on one hand and non-fossil fuel on the other hand. Indeed, several countries become almost fully dependent on desalination for sustainable development. Often seen as the ultimate water supply option, seawater desalination supported the development of the Middle Eastern countries as well as arid regions in Europe, Australia and the United States beyond their environmental limits. With a contracted capacity of 45 million cubic meters in 2012, the global seawater desalination capacity continues to expand at an exponential rate [1]. Following the capacity growth in seawater desalination, current interest is on the environmental performance of desalination. In general, desalination could cause major adverse impacts due to energy intensity and seawater pollution with concentrated brine. Although desalination processes have improved significantly, major reduction in desalination's adverse impacts (on the atmosphere, marine environment, land use, etc.) is only possible through co-located operation with power plants. In such a way, the environmental performance optimization of a desalination facility brings out the issue of power plant selection for co-located operation, since its footprint will be reflected in the environmental issues of the desalination facility. Recognized as low-carbon energy, nuclear is a strong candidate for such co-located desalination facilities. The coined term “nuclear desalination” defines production of potable water from seawater in a facility in which a nuclear reactor is used as the source of energy for the desalination process [2]. Electrical and/or thermal energy may be used in the desalination process. The facility may be dedicated solely to the production of potable water, or may be used for the generation of electricity and production of potable water, in which case only a portion of the total energy output of the reactor is used for water production. So far, nuclear desalination has accumulated more than 200 reactor-years of experience worldwide. As the need for low-carbon options renewed and even enhanced the interest for nuclear desalination in many countries, a preliminary assessment of pathways of radiation and prevention measures based on gathered and applicable experiences seems appropriate [3]. As with other industries, normal safety practices are applied to desalination plants in order to ensure proper protection of the plant personnel and the public. Yet, for nuclear desalination both nuclear safety as well as industrial safety must be ensured. Coupling of the heat source to the desalination plant is obtained via a heat transfer circuit. With a fossil fuelled boiler, coupling is relatively simple but, for a nuclear reactor, the risk of possible radioactive contamination of the potable water produced must be avoided. Here, the philosophy of “safety first” has always been applied, and although accidents have happened, the safety record of the nuclear industry can compare favorably with any other energy source, even if this is not always perceived in this way by the public, the media or politicians. In fact, achievement of adequate safety levels is the responsibility of the operating organization. Establishing safety goals, rules and regulations which must be complied with by the nuclear reactor and the operating organization are the responsibility of the national regulatory authority, which is also responsible for inspection and enforcement to ensure compliance. When the respective sites of a nuclear power plant and of a desalination plant are separate and reasonably distant, the (nuclear) safety requirements for the nuclear reactor are not affected by the fact that the energy generated is used for desalination. For adjacent siting, however, there might be stricter criteria for the release of radioactive effluents under normal conditions, as well as for acceptable levels of risk regarding potential accidents, in order to reduce the risk of contaminating the desalination plant and its product, potable water. This is due to proximity – but not linkage – to a radioactive source. Monitoring the water, some additional safety items and licensing may add some expenses and procedural work. The probable damage is extremely low but the psychological effect might be disturbing [4]. Safety issues and potential contamination is a very important issue regarding the public perception of such projects [5]. Desalination plants are expected to produce water with well-defined quality requirements, which are adopted taking into account the end use. Protection from contamination is important, and if energy in the form of heat (hot water or steam) is supplied by a nuclear reactor to a desalination plant with a distillation process (MED or MSF), measures must be taken to avoid any conceivable risk. Unless the design of the reactor excludes the possibility of the radioactive contamination reaching the desalination plant and the water it produces, an additional intermediate heat exchange circuit would be needed, with a somewhat higher pressure on the desalination plant side, to ensure that if any mixing or releases should occur, these would flow in the direction of the reactor. For desalination plants using a membrane process such as RO or MED/VC, which requires electricity only, there is of course no risk of radioactive contamination reaching the desalination plant through the energy transfer connection. The nuclear industry is continuously striving for the achievement of improved nuclear safety levels in the design, construction and operation of nuclear reactors through technological development. In particular, all advanced reactor concepts share the common goal of enhancing safety. While the measures and solutions of the various concepts differ, the goal is the same. From the point of view of assessing the safety of a particular advanced reactor concept, it is the overall assessment of the reactor which is important, and not the assessment of individual systems, components or measures taken separately [6]. This paper presents a summary of practical measures/concepts that are typically considered in nuclear desalination plants aiming at ensuring that product water is free of any radioactive contamination.

#### Nuclear Power desalination is the most cost-effective form of desalination

Committee on Advancing Desalination Technology, ’08, Water Science and Technology Board,

Division on Earth and Life Studies, “Desalination: A National Perspective”, The National Academies Press, nap.edu

Most desalination today uses fossil fuels, and thus contributes to increased levels of greenhouse gases. Total world capacity in mid-2012 was 80 million m³/day (29,200 GL/yr) of potable water, in some 15,000 plants. A majority of these are in the Middle East and north Africa. The largest plant – the $3.8 billion Al-Jubail 2 in Saudi Arabia – has 948,000 m3/day (346 GL/yr) MED-TVC capacity, plus 2745 MWe power generation using gas turbines. The Saudi Saline Water Conversion Corporation (SWCC) takes about 62% of output to supply Riyadh. Two-thirds of the world capacity is processing seawater, and one third uses brackish artesian water. New plants with total capacity of 6 million m3/d are expected to come on line in 2013, according to the International Desalination Association. The major technology in use and being built today is reverse osmosis (RO) driven by electric pumps which pressurise water and force it through a membrane against its osmotic pressure\*. This accounted for 60% of 2011 world capacity. A thermal process, multi-stage flash (MSF) distillation process using steam, was earlier prominent and it is capable of using waste heat from power plants. It accounted for 26% of capacity in 2011. With brackish water, RO is much more cost-effective, though MSF gives purer water than RO. A minority of plants use multiple-effect distillation (MED – 8% of world capacity) or multi-effect vapour compression (MVC) or a combination of these, eg MED-TVC with thermal vapour compression. MSF-RO hybrid plants exploit the best features of each technology for different quality products. \* About 27 Bar, 2700 kPa. Therefore RO needs compression of much more than this. Desalination is energy-intensive. Reverse Osmosis needs up to 6 kWh of electricity per cubic metre of water (depending on both process and its original salt content), though the latest RO plants such as in Perth, Western Australia, use 3.5 kWh/m3, or 4 kWh/m3 including pumping for distribution. Hence 1 MWe continuous will produce about 4000 to 6000 m3 per day from seawater. MSF and MED require heat at 70-130°C and use 25-200 kWh/m³, though a newer version of MED (MED-MVC) is reported at 10 kWh/m3 and competitive with RO. A variety of low-temperature and waste heat sources may be used, including solar energy, so the above kilowatt-hour figures are not properly comparable. For brackish water and reclamation of municipal wastewater RO requires only about 1 kWh/m3. The choice of process generally depends on the relative economic values of fresh water and particular fuels, and whether cogeneration is a possibility. Forward osmosis (FO) may be used in conjunction with a subsequent process for desalination. The FO draws water through a membrane from a feed solution into a more concentrated draw solution, which is then desalinated without the problems of fouling, such as often encountered with simple RO. FO plants operate in Gibraltar and Oman. Some 10% of Israel's water is desalinated, and one large RO plant provides water at 50 cents per cubic metre. It claimed to have the world’s largest seawater RO plant as of late 2013, at Soreq. Malta gets two-thirds of its potable water from RO, and this takes 4% of its electricity supply. Singapore in 2005 commissioned a large RO seawater desal plant supplying 136,000 m3/day – 10% of needs, at 49 cents US per cubic metre, and in 2013 commissioned a 318,500 m3/d RO plant on a build-own-operate basis, costing US$ 700 million, to provide water at US 36 cents/m3. Desalinated seawater will now provide 25% of Singapore's water, as one of the island state's Four National Taps, along with local catchment water, imported water, and NEWater, Singapore's own recycled wastewater. Saudi Arabia in 2011 obtained 3.3 million m3/d from 27 government-owned (SWCC) seawater desalination plants, 70% of the country’s requirements. Twelve plants, accounting for most of production, use multi-stage flash distillation (MSF) and 7 plants use multi-effect distillation (MED), in both cases the plants are integrated with power plants (cogeneration plants), using steam from the power generation as a source of energy for desalination. Eight plants are single-purpose plants that use reverse osmosis (RO) technology and power from the grid. The UAE is heavily dependent on seawater desalination, much of it with cogeneration plants. Algeria in mid 2013 had 2.1 million m3/d capacity and another 400,000 m3/d is envisaged. In February 2012 China's State Council announced that it aimed to have 2.2 to 2.6 million m3/day seawater desalination capacity operating by 2015. Small and medium sized nuclear reactors are suitable for desalination, often with cogeneration of electricity using low-pressure steam from the turbine and hot seawater feed from the final cooling system. The main opportunities for nuclear plants have been identified as the 80-100,000 m³/day and 200-500,000 m³/day ranges. US Navy nuclear powered aircraft carriers reportedly desalinate 1500 m3/d each for use onboard. A 2006 IAEA report based on country case studies showed that costs would be in the range ($US) 50 to 94 cents/m3 for RO, 60 to 96 c/m3 for MED and $1.18 to 1.48/m3 for MSF processes, with marked economies of scale. Nuclear power was very competitive at today's gas and oil prices. A French study for Tunisia compared four nuclear power options with combined cycle gas turbine and found that nuclear desalination costs were about half those of the gas plant for MED technology and about one third less for RO. With all energy sources, desalination costs with RO were lower than MED costs. The Kwinana desalination plant near Perth, Western Australia, has been running since early 2007 and produces about 140,000 m3/day (45 GL/yr) of potable water, requiring 24 MWe of power for this, hence 576,000 kWh/day, hence 4.1 kWh/m3 overall, and about 3.7 kWh/m3 across the membranes. The plant has pre-treatment, then 12 seawater RO trains with capacity of 160,000 m3/day which feed six secondary trains producing 144,000 m3/day of water with 50 mg/L total dissolved solids. The cost is estimated at A$ 1.20/m3. Discharge flow is about 7% salt. Future WA desalination plants will have more sophisticated pre-treatment to increase efficiency. In August 2011 the state government decided to double the size of its new Southern Water Desal Plant at Binningup plant near Perth to 100 GL/yr, taking the cost to about $1.45 billion. Stage 1 of 50 GL/yr was within the A$ 955 million budget. At the April 2010 Global Water Summit in Paris, the prospect of desalination plants being co-located with nuclear power plants was supported by leading international water experts.

#### Desalination plants are being modelled globally since there are severe fresh water shortages

Inderscience, ’07, Publishers of distinguished academic, scientific and professional journals

“Could Nuclear Power Be The Answer To Fresh Water?”, Science Daily, Inderscience Publishers

Scientists are working on new solutions to the ancient problem of maintaining a fresh water supply. With predictions that more than 3.5 billion people will live in areas facing severe water shortages by the year 2025, the challenge is to find an environmentally benign way to remove salt from seawater. Global climate change, desertification, and over-population are already taking their toll on fresh water supplies. In coming years, fresh water could become a rare and expensive commodity. Research results presented at the Trombay Symposium on Desalination and Water Reuse offer a new perspective on desalination and describe alternatives to the current expensive and inefficient methods. Pradip Tewari of the Desalination Division at Bhabha Atomic Research Centre, in Mumbai, India, discusses the increasing demand for water in India driven not only by growing population and expectancies rapid agricultural and industrial expansion. He suggests that a holistic approach is needed to cope with freshwater needs, which include primarily seawater desalination in coastal areas and brackish water desalination as well as rainwater harvesting, particularly during the monsoon season. "The contribution of seawater and brackish water desalination would play an important role in augmenting the freshwater needs of the country." Meenakshi Jain of CDM & Environmental Services and Positive Climate Care Pvt Ltd in Jaipur highlights the energy problem facing regions with little fresh water. "Desalination is an energy-intensive process. Over the long term, desalination with fossil energy sources would not be compatible with sustainable development; fossil fuel reserves are finite and must be conserved for other essential uses, whereas demands for desalted water would continue to increase." Jain emphasizes that a sustainable, non-polluting solution to water shortages is essential. Renewable energy sources, such as wind, solar, and wave power, may be used in conjunction to generate electricity and to carry out desalination, which could have a significant impact on reducing potential increased greenhouse gas emissions. "Nuclear energy seawater desalination has a tremendous potential for the production of freshwater," Jain adds. The development of a floating nuclear plant is one of the more surprising solutions to the desalination problem. S.S. Verma of the Department of Physics at SLIET in Punjab, points out that small floating nuclear power plants represent a way to produce electrical energy with minimal environmental pollution and greenhouse gas emissions. Such plants could be sited offshore anywhere there is dense coastal population and not only provide cheap electricity but be used to power a desalination plant with their excess heat. "Companies are already in the process of developing a special desalination platform for attachment to FNPPs helping the reactor to desalinate seawater," Verma points out. A. Raha and colleagues at the Desalination Division of the Bhabha Atomic Research Centre, in Trombay, point out that Low-Temperature Evaporation (LTE) desalination technology utilizing low-quality waste heat in the form of hot water (as low as 50 Celsius) or low-pressure steam from a nuclear power plant has been developed to produce high-purity water directly from seawater. Safety, reliability, viable economics, have already been demonstrated. BARC itself has recently commissioned a 50 tons per day low-temperature desalination plant. Co-editor of the journal\*, B.M. Misra, formerly head of BARC, suggests that solar, wind, and wave power, while seemingly cost effective approaches to desalination, are not viable for the kind of large-scale fresh water production that an increasingly industrial and growing population needs. India already has plans for the rapid expansion of its nuclear power industry. Misra suggests that large-scale desalination plants could readily be incorporated into those plans. "The development of advanced reactors providing heat for hydrogen production and large amount of waste heat will catalyze the large-scale seawater desalination for economic production of fresh water," he says.

### 2NC – Current Desal Fails

#### **Current desalination efforts are unsustainable – nuclear solves**

IAEA 7 – International Atomic Energy Agency

(“Economics of Nuclear Desalination: New Developments and Site Specific Studies,” July 2007, http://www-pub.iaea.org/MTCD/publications/PDF/te\_1561\_web.pdf)//ac

Environmental impact of desalination by fossil fuelled energy sources Desalination is an energy intensive process. A future desalination strategy based only on the use of fossil fuelled systems is not sustainable: Fossil fuel reserves are finite and must be conserved for more important uses such as transport, petrochemical industry etc. Besides, the demands for desalted water would continue increasing as population grows and standards of living improve. Conservation measures such as the modernisation of water networks to minimise leakages, the recycling of used water etc. will certainly reduce the future water demands slightly but they would not be able to halt the dissemination of desalination plants and consequently of the fossil fuelled based systems for the production of needed electricity and heat. The following paragraphs illustrate the damaging consequences of such a policy by taking the example of the Mediterranean region. Following the recent “Blue Plan” [2], the total available natural water resources (1), based on the statistics from 1990 to 1998, in the principle countries of the Mediterranean region, are as shown in Table 2. The projected demands (3) for the year 2025 [31] are also included in Table 1. It is obvious that available natural water resources would rather decrease in 2025 because of increased pollution, over exploitation and other human activities. However, to keep matters simple, it would be supposed that they would remain at the same level as in 1998. It is obvious that available natural water resources would rather decrease in 2025 because of increased pollution, over exploitation and other human activities. However, to keep matters simple, it would be supposed that they would remain at the same level as today. It can be observed that, in 2025, the total projected water deficit (balance) in the Mediterranean region would of the order of 294 km3/per year. Not all this required capacity would be met by desalination plants. Current contribution of desalination is of the order of 1 to 2 %. If it is supposed that in 2025, this contribution would be about 2.5 %, then the total required desalting capacity would be 7.3 km3/year (20.1 million m3/day). 6 According to the EC ExternE study2, the total emissions of GHG per MW(e).h of electricity produced by representative fossil fuelled power plants in France, are as presented in Table 3. It can thus be concluded that for a desalting capacity of 20.1 million m3/day in the Mediterranean region alone, required in 2025, one would produce, depending upon the energy source and the desalination process used, 13 to 264 million tonnes/year of CO2. 1350 to 1 310 000 tonnes/year of SOx. 21 100 to 540 000 tonnes/year of NOx. 1190 to 40 000 tonnes/year of particles. The potential levels of GHG and particle emissions on the world scale could then be more than double these figures. These could naturally be avoided through the use of nuclear energy.

### 2NC – A2 Unpractical

#### Models exist in the status quo

IAEA 15

[-- widely known as the world's "Atoms for Peace" organization within the United Nations family. Set up in 1957 as the world's centre for cooperation in the nuclear field, the Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies, “New Technologies for Seawater Desalination Using Nuclear Energy,” IEAE TecDoc Series, 2015]

There is a great interest in using nuclear energy for producing desalinated water. This interest is growing worldwide, motivated by a wide variety of reasons such as the economic competitiveness of nuclear energy and energy supply diversification. It seems that it is the time to go beyond techno-economic studies, and invest in promoting R&D on new technologies that can be employed in nuclear desalination systems to make nuclear desalination a viable option. One of the distinct results of this CRP was the close collaboration established and information sharing among participants to the CRP. The range of desalination technologies available to couple with nuclear power stations was presented, their pros and cons compared via an economic evaluation and comparison of the various energy source options coupled with different seawater desalination processes. In particular, LT desalination technologies such as HT multieffect distillation and hybrid desalination systems are found to be especially efficient, with reduced pretreatment costs and required pumping power in addition to having an increased desalinated water recovery ratio when compared to other processes. The use of heat pipes as heat transfer devices has been proposed and they do seem like a reasonable alternative, as when equipping heat exchangers, they allow for a complete flow separation as well as boosting lower operation and maintenance costs, reducing the risk of leaks in the desalination loop. New modelling approaches were suggested by participants from France and USA. The suggested model by the French authority for nuclear energy was intended to set up a simulation programme for different desalination plants. The US-suggested model was an Excel-based financial modelling tool which was used to perform NPV calculations for cogeneration projects. The simulation model is useful for the development of nuclear desalination simulator in the future. However, the second model has already been used for multiple case studies to demonstrate the model outputs for determining the feasibility of cogeneration projects at site-specific locations. A sensitivity analysis was also performed to investigate the impacts of desalination units on climate change. It was found that the amount and the cost of the greenhouse emissions depends on a range of variables, including the power required, the efficiency, plant lifetime and fuel consumption. An update to the DEEP was also done, with the purpose of increasing the model’s robustness and reliability to predict the cost of different power plants. A major update of DEEP was based on the US-suggested model for NPV analysis. Several predictions were done with the software and it was found that the costs for the distinct types of units change wildly depending on the application. The comparison with solar stills was not possible due to lack of significant data available The biggest case study available was that of Skikda, in Algeria, a plant that was constructed due to the lack of potable water in Algeria. It was proven that nuclear desalination option is more competitive compared to desalination based on fossil energy mainly based on the pollution caused by the latter as well as higher cost per litre of water. 100 Overall the CRP was a very successful event, for both the showcase of new technology and applications of current models in real-life power plants. A great part of the CRP work was directed towards modification of DEEP software and the development of a precise model, which estimates the performance and evaluates the economics of the MED/TVC system. Hybrid nuclear desalination systems do seem to be the way forward for both energy and drinkable water production.

#### California proves

Conca 15 [James Conca, "California's Mega-Drought: Nuclear Power To The Rescue," Forbes Magazine, June 2015] AZ

The only power facility in California that does not use any of the state’s precious fresh water is the Diablo Canyon Nuclear Power Plant in San Luis Obispo County. And it can even produce additional freshwater for the nearby community. The nuclear plant desalinates ocean water using reverse osmosis and ultrafiltration. The nuclear plant depends on the desalination plant as its sole source of fresh water, used for the plant’s two nuclear reactors as well as all other water needs such as drinking water for its employees and irrigation of its grounds. Although a relatively small plant, Diablo Canyon’s seawater desalination plant is presently the largest operating desal facility on the West Coast, producing about 675,000 gallons of freshwater a day. But the desal facility is not running at maximum capacity. It can actually produce a million and a half gallons of fresh water a day, and can ramp up right now, with very little upgrade and additional costs.

### ! – Water Leadership

#### That’s key to global US water leadership – harnesses diplomatic leverage at key subnational actors – de-escalates conflict, provides governmental legitimacy, and

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(Marcus DuBois King, October 15,2013, “Water, U.S. Foreign Policy and American Leadership”, http://elliott.gwu.edu/sites/elliott.gwu.edu/files/downloads/faculty/king-water-policy-leadership.pdf)

The USG has the opportunity to prioritize, develop and implement stronger water management policies that address development, diplomacy and defense challenges. Participants found that access to water is an urgent issue, and that the time is ripe for a “whole of government” approach to pursue the opportunities that water affords. This approach includes greater U.S. advocacy for water projects within multilateral development institutions such as the World Bank. Three conditions are necessary to implement effective water programs. There must be a clear mission statement, sufficient funding and the will power to execute it. Participants found these conditions are often extremely difficult to meet even in countries that are in obvious need of assistance. The ICA can facilitate operational guidance. The 2012 ICA, written at the request of the State Department, has increased the visibility of water within the Administration and in Congress. The classified National Intelligence Assessment on the National Security Implications of Global Climate Change to 2030, released in 2008, played a key role in elevating climate considerations into key strategic documents such as DoD’s QDR and the National Security Strategy. This led the armed services and others to begin incorporating climate change mitigation, adaptation and response strategies into their operations. The same need and opportunity exists today with water. Lack of information sharing within and between government agencies is a key vulnerability. There is no system in place for sharing information between the various USG actors and stakeholders with roles in water projects. Both “vertical” information sharing - such as that within an agency - and “horizontal” sharing - between agencies - have been equally problematic. A stronger system would support best and emerging practices in water management. Coordination with non-USG actors is equally important. As one meeting participant observed, “each side does not know the top ten blazing success stories of the other.” Lack of technical skills in the USG also presents barriers. USAID lacks sufficient technical and financial resources to implement water development projects even where there has been an identified need and tangible opportunity. This prevents the agency from providing technical hydrological data to countries where assistance may be needed. Hydrological models and other land use data are often unavailable for countries where the USG may intend to offer development assistance or arbitrate conflict. While USAID and NGOs that are under resourced or new to water development lack these capabilities, substantial technical experience exists within agencies such as NASA, NOAA and USGS, as well as the intelligence community. Tapping this expertise presents a challenge in that doing so affects agency budgets and work force levels by adding new demands on already constrained resources. The “water workforce” has diminished. The knowledge base of the USAID water workforce has been eroded over time as 20 employees with specialized knowledge have retired, been replaced or shifted to other development priorities. Since U.S. development assistance is mission driven, the lack of technical skills deployed at the host country level provides a serious impediment to developing more robust programs on water resources. New diplomatic approaches are necessary. Water problems are often subnational or transnational, while traditional diplomacy is undertaken directly with the national government. However, engaging governments exclusively at the national level may not be adequate when that government displays low governance capacity. The USG lacks the optimal mechanisms and institutions to tackle water challenges up and down the various levels of host country governments. For example, effective Integrated Water Resource Management (IWRM) operates on an ecosystem basis that does not usually align with political boundaries of any kind. Water projects present opportunities for post-conflict reconstruction and stabilization. In conflict itself, a large number of deaths are caused by a lack of access to health care and the spread of disease resulting from a lack of clean water and sanitation. Weak governments recovering from conflict situations may also have trouble providing these services. When governments are unable to provide adequate infrastructure, they lose legitimacy. In some cases, subnational organizations prone to radicalization provide public services in place of weak governments. U.S. water assistance could help national governments stabilize and regain their legitimacy.

#### That’s key to diplomatic leveraging in a number of hotspots

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(Marcus DuBois King, October 15,2013, “Water, U.S. Foreign Policy and American Leadership”, http://elliott.gwu.edu/sites/elliott.gwu.edu/files/downloads/faculty/king-water-policy-leadership.pdf)

Second, traditional diplomacy is based on interactions between and among nation states. With water, however, it can be especially effective to focus on the communities of greatest need even if it must be done on a subnational (provincial, municipal) basis. Pakistan is an example of where aid can be more effectively targeted toward “local pockets” which have significant water challenges and where there is more of an opportunity to succeed. The landmark Senator Paul Simon Water for the Poor Act of 2005 advocates this approach. The Water for the World Act of 2013 is bipartisan legislation designed to further improve the efficiency of water aid delivery. It requires greater transparency – advocating best practices such as improved monitoring and evaluation and leveraging non-USG funds. The multilateral and transboundary nature of many water issues such as those involving shared river basins presents a similar set of diplomatic challenges. Solutions targeted toward individual states are not effective under these conditions and regional organizations or negotiation regimes (to which the United States may not be a party) are generally most effective. The session identified another vexing problem. Opportunities for the exercise of “soft” power are lost because successful USG water programs often go unrecognized both by the USG and by the people who benefit from them. The importance of the USG not taking credit for projects in situations where it would diminish perceptions of the effectiveness of the host nation’s government was described as necessary in some cases. Despite these challenges, tremendous opportunity exists for the United States to strengthen its global leadership role by making water issues a foreign policy focal point of a soft” power strategy. For example, the State Department could facilitate early discussions about emerging water conflict or assistance in the development of water sharing regimes in areas such as the Himalayan Plateau, and the Jordan, Indus, Mekong, Nile, and Tigris-Euphrates river basins.

### 2NR OV

#### Rising populations, urban development, and price volatility of fossil fuels make effective and sustainable desalinization plants more important than ever – the aff's removal of nuclear energy destroys long-term potential for converting saltwater into potable water – that causes conflicts over scarce resources that escalate and go global

Turns and outweighs the aff

1. desperate states aren't checked by traditional institutions or obligations – thirsty populations will push leaders to go into wars even where usually alliances or deterrence would solve
2. causes prolif – ensures a hostile environment where states are incentivized to protect themselves against attackers and proliferate as a survival strategy
3. faster – draws in local powers quickly since attacks for water are rapid and designed to take a resource rather than conquer a nation

### 1NC – China Desal

#### China is experiencing increasing water shortages – nuclear desal is key to solve

Avrin 15 [Anne-Perrine Avrin, Gang He, Daniel M. Kammen, "Assessing the impacts of nuclear desalination and geoengineering to address China's water shortages," Desalination, 2015] AZ

In China, several provinces, especially in the North and East, experience moderate to severe water shortages, affecting municipal, industrial, and agriculture needs. The total national shortage in 2030 is forecasted to be nearly 200 billion m3 with more than 25% for domestic needs [1]. Water-use efficiency, recycling and conservation programs have been implemented to save water, but they have not addressed the shortage issue in its totality. Cross-region water diversion projects have been undertaken to address lack of water. In particular, the South-to-North Water Transfer Project (STNWP), presented in Fig. 1, aims at diverting about 27 billion m3 of water from Yangtze River and Danjiangkou reservoir to water-scarce Northern provinces. This project, expected to cost more than $30 billion for the Eastern and Central routes, and to require 530 MW of energy generation for pumping capacity, will not increase the total quantity of water available to the nation. Its costs, scale, and impacts warrant a framework to alternative, possibly unconventional, approaches. One such alternative is the use of seawater to address fresh water needs through desalination. Desalination can play a major role for coastal cities, communities where fresh water access costs are high, or where the average electricity consumption to produce one cubic meter of water is higher than 6 kWh (see SI–S2 for calculation details). China already uses desalination through coal-fired plants. However, today, the country has 69 desalination facilities producing, in total, around 400,000 to 500,000 m3 per day — not even reaching the scale of a single Middle Eastern desalination plant [2]. At the same time, China is massively developing nuclear power. Hot steam from nuclear reactors can be used for desalination. The purpose of this study is to determine if and under what assumptions, in the long term, nuclear desalination can prove itself to be more appropriate to China than water diversion projects and coal desalination. The choice of a 2030 horizon results from a trade-off between the need of a period of time long enough to expect substantial evolution in the Chinese nuclear fleet, and the uncertainty of long-term planning.

#### Causes war with India, Pakistan, South Asia, and a civil war with Tibet

Washington Times 16 ["Preventing a water war in Asia," 2016] AZ

Just when Asia was getting accustomed to the Chinese threat to the oceans of Southeast Asia, there’s another water worry for Asians. The government in Beijing controls the health of six major South and Southeastern Asian rivers, the heart of life in the region. All of the rivers rise on the Tibetan plateau. The Chinese have been on an intensive program of dam-building on the upper reaches of the Brahmaputra, the Irrawaddy, the Meman Chao Phya and the Mekong, which would give them the ability to control these arteries of commerce, as well as irrigation of rice and other crops, for vast areas downstream. Snows are melting on thousands of glaciers, the largest concentration of ice north and south of the poles, repeating the ancient and constant cycle of change in the world’s weather. One Tibetan lake, Namtso, a holy site where pilgrims circumnavigate its banks in prayer, expanded by 20 square miles between 2000 and 2014. Tibet’s glaciers have shrunk by 15 percent over the past 30 years. Though subject to the whims of climate change, if melting continues at current levels the warmer temperatures could melt two-thirds of the plateau’s glaciers by 2050, and this would affect in unknown ways 2 billion people in China, India, Pakistan, Bangladesh, Bhutan, Burma, Thailand, Laos, Cambodia and Vietnam. The most dramatic example of prospective risk is China’s plan to divert the Brahmaputra from its upper reaches, where it flows a thousand miles through Tibet and another 600 miles through India, emptying into the harbor of Calcutta, the second-largest city of China. The Brahmaputra is the lifeline of northeast India, a troubled region with caste and other ethnic conflicts. There’s concern in Thailand, Laos, Vietnam and Cambodia over eight dams under construction on the upper reaches of the Mekong River. The Burmese military junta canceled a dam under construction in Myanmar, formerly called Burma, one of six Chinese-led hydroelectric projects planned for the upper reaches of the Irrawaddy. These plants would have exported electricity to southern China. Government and the business interests worry that China’s apparent intention to dam every major river flowing out of Tibet will lead to environmental imbalance, natural disasters, degrade fragile ecologies, and most of all, divert vital water supplies. The extent of the Chinese program is monumental — on the eight great Tibetan rivers alone, China has completed or started construction of 20 dams, with three-dozen more on the drawing board. The Dalai Lama points out the obvious, that China’s dam-building could lead to conflict. He warns that India’s use of the Tibetan water “is something very, very essential. So, since millions of Indians use water coming from the Himalayan glaciers I think [India] should express more serious concern. This is nothing to do with politics, just everybody’s interests, including Chinese people.”

#### Water shortages cause China-India war over the Brahmaputra river

Ramachandran 15 [Sudha Ramachandran, "Water Wars: China, India and the Great Dam Rush," The Diplomat, 4/3/ 2015] AZ

However, the lack of communication on the issue is deepening suspicion and tension. This underscores the need for dialogue that includes all the riparian countries. China must share data with India and Bangladesh on its dam construction and other plans for the Brahmaputra. Meanwhile in a bid to exploit the immense hydropower potential of the Brahmaputra and importantly, to establish prior use rights, the Indian government is on a massive dam building spree – including mega dams as well micro-hydel projects – in Arunachal Pradesh. Environmental and other norms are being flouted in the construction of these projects. These could worsen the water flow for the people further downstream in Assam and Bangladesh, deepening existing problems and triggering new conflicts. Some have suggested that a joint India-Bangladesh effort on the question of China’s damming of the Brahmaputra may be effective. This is unlikely given China’s preference for bilateral approaches to dispute resolution. And importantly, there is little difference between the strategies of India and China on dam building or water diversion. India may worry about Chinese plans for diverting the Brahmaputra’s waters but the present Indian government too is keen on diverting India’s northern rivers. While such plans are still on the drawing board, it has not consulted its neighbors, the lower riparian countries, on this project or on hundreds of others in the past. Ask the Bangladeshis. They will tell you that both China and India are arrogant upstream superpowers.

#### This turns to war- both countries are armed with nuclear weapons and are easily pushed over the brink

Malik 12 (Malik, Mohan. Professor at the Asia-Pacific Center for Security Studies. “China and India Today: Diplomats Jostle, Militaries Prepare”. World Affairs Journal. July/August 2012. <http://www.worldaffairsjournal.org/article/china-and-india-today-diplomats-jostle-militaries-prepare>)

Just as the Indian subcontinental plate has a tendency to constantly rub and push against the Eurasian tectonic plate, causing friction and volatility in the entire Himalayan mountain range, India’s bilateral relationship with China is also a subtle, unseen, but ongoing and deeply felt collision, the affects of which have left a convoluted lineage. Tensions between the two powers have come to influence everything from their military and security decisionmaking to their economic and diplomatic maneuvering, with implications for wary neighbors and faraway allies alike. The relationship is complicated by layers of rivalry, mistrust, and occasional cooperation, not to mention actual geographical disputes. Distant neighbors buffered by Tibet and the Himalayas for millennia, China and India became next-door neighbors with contested frontiers and disputed histories in 1950, following the occupation of Tibet by Mao’s People’s Liberation Army (PLA). While the rest of the world started taking note of China’s rise during the last decade of the twentieth century, India has been warily watching China’s rise ever since a territorial dispute erupted in a brief but full-scale war in 1962, followed by skirmishes in 1967 and 1987. Several rounds of talks held since 1981 have failed to resolve the disputed claims. During his last visit to India, in 2010, Chinese Premier Wen Jiabao dashed any hopes of early border settlement, stating that it would take a very long time to settle the boundary issue—a situation that in many ways works to Beijing’s advantage. An unsettled border provides China the strategic leverage to keep India uncertain about its intentions, and nervous about its capabilities, while exposing India’s vulnerabilities and weaknesses, and encouraging New Delhi’s “good behavior” on issues of vital concern. Besides, as the ongoing unrest and growing incidents of self-immolations by Buddhist monks in Tibet show, Beijing has not yet succeeded in pacifying and Sinicizing Tibet, as it has Inner Mongolia. The net result is that the 2,520-mile Sino-Indian frontier, one of the longest inter-state boundaries in the world, remains China’s only undefined land border. It is also becoming heavily militarized, as tensions rise over China’s aggressive patrolling on the line of actual control (LAC) and its military drills, using live ammunition, for a potential air and land campaign to capture high-altitude mountain passes in Tibet. Over the last decade, the Chinese have put in place a sophisticated military infrastructure in the Tibet Autonomous Region (TAR) adjoining India: five fully operational air bases, several helipads, an extensive rail network, and thirty thousand miles of roads—giving them the ability to rapidly deploy thirty divisions (fifteen thousand soldiers each) along the border, a three-to-one advantage over India. China has not only increased its military presence in Tibet but is also ramping up its nuclear arsenal. In addition, the PLA’s strategic options against India are set to multiply as Chinese land and rail links with Pakistan, Nepal, Burma, and Bangladesh improve. Developments on the disputed Himalayan borders are central to India’s internal debate about the credibility of its strategic deterrent and whether to test nuclear weapons again. Being the weaker power, India is far more concerned about the overall military balance tilting to its disadvantage. India sees China everywhere because of Beijing’s “hexiao gongda” policy in South Asia: “uniting with the small”—Pakistan, Bangladesh, Nepal, Burma, and Sri Lanka—“to counter the big”—India. When combined with Chinese nuclear and missile transfers to Pakistan and building of port facilities around India’s periphery, and a dramatic increase in the PLA’s incursions and transgressions across the LAC, the official Indian perception of China has undergone a dramatic shift since 2006, with China now being widely seen as posing a major security threat in the short to medium term rather than over the long term. The Indian military, long preoccupied with war-fighting scenarios against Pakistan, has consequently turned its attention to the China border, and unveiled a massive force modernization program, to cost $100 billion over the next decade, that includes the construction of several strategic roads and the expansion of rail networks, helipads, and airfields all along the LAC. Other measures range from raising a new mountain strike corps and doubling force levels in the eastern sector by one hundred thousand troops to the deployment of Sukhoi Su-30MKI aircraft, spy drones, helicopters, and ballistic and cruise missile squadrons to defend its northeastern state of Arunachal Pradesh, territory three times the size of Taiwan that the Chinese invaded in 1962 and now claim sovereignty over as “Southern Tibet.” Propelled by incidents related to border disputes, Chinese opposition to the US-India nuclear energy deal, India’s angst over the growing trade deficit due to perceived Chinese unfair trade practices, potential Chinese plans to dam the Brahmaputra River, and the “war talk” in the official Chinese media in the 2007 to 2009 period (reminding India not to forget “the lessons of 1962”), mutual distrust between the Indian and Chinese peoples is growing. Clearly, China’s extraordinary economic performance over the last three decades has changed the dynamics of the relationship. China and India had similar average incomes in the late 1970s, but thirty years later they find themselves at completely different stages of development. China’s economic reforms—launched in 1978, nearly thirteen years before India’s in 1991—changed their subsequent growth trajectories by putting China far ahead of India in all socioeconomic indices. Both China’s gross domestic product and military expenditure are now three times the size of India’s; recent surveys conducted by Pew Global Research show a growth in popular distrust, with just twenty-five percent of Indians holding a favorable view of China in 2011, down from thirty-four percent in 2010 and fifty-seven percent in 2005. Likewise, just twenty-seven percent of Chinese hold a favorable view of India in 2011, down from thirty-two percent in 2010, with studies of Internet content showing a large degree of “hostility and contempt for India.” Nor is there much effort to keep these emotions submerged. Reacting to the test launch in mid-April of a long-range Agni-V ballistic missile, dubbed the “China killer” by India’s news media, a Chinese daily wryly noted that “India stands no chance in an overall arms race with China,” because “China’s nuclear power is stronger and more reliable.” The unequal strategic equation, in particular the Chinese perception of India as a land of irreconcilable socioreligious cleavages with an inherently unstable polity and weak leadership that is easily contained through proxies, aggravates tensions between the two. In 2008, an official reassessment of China’s capabilities and intentions led the Indian military to adopt a “two-front war” doctrine against what is identified as a “collusive threat” posed by two closely aligned nuclear-armed neighbors, Pakistan and China. This doctrine validates the long-held belief of India’s strategic community that China is following a protracted strategy of containing India’s rise. India is also responding by strengthening its strategic links with Afghanistan, Tajikistan, Mongolia, Vietnam, and Burma—countries on China’s periphery. In testimony to the US Senate in February, James Clapper, the director of national intelligence, noted that “the Indian military is strengthening its forces in preparation to fight a limited conflict along the disputed border, and is working to balance Chinese power projection in the Indian Ocean.” That “balance” includes a strategic tilt toward the United States that has also had a damaging effect on Sino-Indian relations. Although leaders from both countries often repeat the ritualized denials of conflict and emphasize burgeoning trade ties, such platitudes cannot obliterate the trust deficit. Few if any of China’s strategic thinkers seem to hold positive views of India for China’s future, and vice versa. Chinese strategists keep a wary eye on India’s “great power dreams,” its military spending and weapons acquisitions, and the developments in India’s naval and nuclear doctrines. A dominant theme in Chinese commentary in the last decade is that India’s growing strength—backed by the United States—could tip Asia’s balance of power away from Beijing. Not surprisingly, bilateral relations between Asia’s giants remain, in the words of Zhang Yan, China’s ambassador to India, “very fragile, very easy to be damaged, and very difficult to repair.” Both have massive manpower resources, a scientific and industrial base, and million-plus militaries. For the first time in more than fifty years, both are moving upward simultaneously on their relative power trajectories. As the pivotal power in South Asia, India perceives itself much as China has traditionally perceived itself in relation to East Asia. Both desire a peaceful security environment to focus on economic development and avoid overt rivalry or conflict. Still, the volatile agents of nationalism, history, ambition, strength, and size produce a mysterious chemistry. Neither power is comfortable with the rise of the other. Both seek to envelop neighbors with their national economies. Both are nuclear and space powers with growing ambitions. Both yearn for a multipolar world that will provide them the space for growth and freedom of action. Both vie for leadership positions in global and regional organizations and have attempted to establish a sort of Monroe Doctrine in their respective neighborhoods—without much success. And both remain suspicious of each other’s long-term agenda and intentions. Each perceives the other as pursuing hegemony and entertaining imperial ambitions. Both are non–status quo powers: China in terms of territory, power, and influence; India in terms of status, power, and influence. Both seek to expand their power and influence in and beyond their regions at each other’s expense. China’s “Malacca paranoia” is matched by India’s “Hormuz dilemma.” If China’s navy is going south to the Indian Ocean, India’s navy is going east to the Pacific Ocean. Both suffer from a siege mentality born out of their elites’ acute consciousness of the divisive tendencies that make their countries’ present political unity so fragile. After all, much of Chinese and Indian history is made up of long periods of internal disunity and turmoil, when centrifugal forces brought down even the most powerful empires. Each has its vulnerabilities—regional conflicts, poverty, and religious divisions for India; the contradiction between a market economy and Leninist politics for China. Both are plagued with domestic linguistic, ethno-religious, and politico-economic fault lines that could be their undoing if not managed properly. In other words, China and India are locked in a classic security dilemma: one country sees its actions as defensive, but the same actions appear aggressive to the other. Beijing fears that an unrestrained Indian power—particularly one that is backed by the West and Japan—would not only threaten China’s security along its restive southwestern frontiers (Tibet and Xinjiang) but also obstruct China’s expansion southwards. Faced with exponential growth in China’s power and influence, India feels the need to take counterbalancing measures and launch strategic initiatives to emerge as a great power, but these are perceived as challenging and threatening in China.

### ! – Water Wars

#### Water wars coming – central Asia, Middle-East and China-India conflict

Mansharamani 15 [Vikram Mansharamani (lecturer in the Program on Ethics, Politics & Economics at Yale University and a senior fellow at the Mossavar-Rahmani Center for Business and Government at the Harvard Kennedy School), "Column: Water wars are coming" PBS Newshour, November 2015] AZ

The Earth is constantly recycling the water we use. But we’re stressing the system by not allowing it adequate time to replace the growing amounts we demand. “Can’t we just make new water?” you might ask. Well, our galaxy is actually creating new water molecules all the time — enough to fill the oceans of Earth multiple times per hour. Unfortunately, this is happening far from our planet, and it won’t be efficient — at least for the foreseeable future — to transport it here. Our heavy use of freshwater certainly appears to be a problem without an easy solution. And worse, the pressures are building: demand for water is predicted to exceed supply by 40 percent by 2030. The already scarce supply of the freshwater consumable by plants, animals and humans is being further limited by climate change, which is changing historical rainfall patterns and increasing the severity of storms. Meanwhile, demand is driven by agriculture, which accounts for more than 90 percent of freshwater use each year. The same forces driving demand for food — namely a global population boom and increasing preferences within that population for animal protein — are placing unsustainable pressure on water supplies. Climate change and food-driven water demand are creating a toxic cocktail that may shock global stability. We are already flirting with severe water shortages on a regular basis. Consider that one in four large cities are “water stressed,” according to the Nature Conservancy. Barcelona came within days of running out of water in 2008 and was forced to import a tanker of drinking water. California, which has been warming for the last 30 years, has been suffering its worst drought in 1,200 years, one study found. In South Africa, another terrible drought has forced Johannesburg to impose restrictions on water use. By 2025, two-thirds of the world’s population could be living under water-stressed conditions. Water wars are coming. The U.S. National Intelligence Strategy, released in September of last year, highlights an elevated potential for water scarcity to generate instability. And a U.S. intelligence community report on Global Water Security released in 2012 warned: “During the next 10 years, many countries important to the United States will experience water problems — shortages, poor water quality, or floods — that will risk instability and state failure, increase regional tensions, and distract them from working with the United States on important U.S. policy objectives.” Might water wars already be brewing? Pakistan, one of the most water-stressed countries in the world, has an ongoing dispute with India over access to water in which radicals have called for “water jihad.” New Delhi also fears that a new Chinese dam project in Tibet could be used to restrict water supplies downstream in northern India. In March, an Ethiopian dam under construction that could have limited Egyptian and Sudanese access to water nearly generated conflict. In central Asia, there is a similar ongoing disagreement over a Tajikistani dam that could restrict water access in Uzbekistan. These are but a few of the water tensions bubbling globally. The sad reality of the situation is that it may soon be time to update the Coleridge quote with which I began this piece to “Water wars everywhere, nor any drop for peace.”

#### Water wars risk instability, terrorism, and inhibit cooperation with America – multiple hotspots for escalation globally

Goldenberg 14 – US environment correspondent

(Suzanne, “Why global water shortages pose threat of terror and war,” The Guardian, 2/8/14, http://www.theguardian.com/environment/2014/feb/09/global-water-shortages-threat-terror-war)//ac

On 17 January, scientists downloaded fresh data from a pair of Nasa satellites and distributed the findings among the small group of researchers who track the world's water reserves. At the University of California, Irvine, hydrologist James Famiglietti looked over the data from the gravity-sensing Grace satellites with a rising sense of dread. The data, released last week, showed California on the verge of an epic drought, with its backup systems of groundwater reserves so run down that the losses could be picked up by satellites orbiting 400km above the Earth's surface. "It was definitely an 'oh my gosh moment'," Famiglietti said. "The groundwater is our strategic reserve. It's our backup, and so where do you go when the backup is gone?" That same day, the state governor, Jerry Brown, declared a drought emergency and appealed to Californians to cut their water use by 20%. "Every day this drought goes on we are going to have to tighten the screws on what people are doing," he said. Seventeen rural communities are in danger of running out of water within 60 days and that number is expected to rise, after the main municipal water distribution system announced it did not have enough supplies and would have to turn off the taps to local agencies. There are other shock moments ahead – and not just for California – in a world where water is increasingly in short supply because of growing demands from agriculture, an expanding population, energy production and climate change. Already a billion people, or one in seven people on the planet, lack access to safe drinking water. Britain, of course, is currently at the other extreme. Great swaths of the country are drowning in misery, after a series of Atlantic storms off the south-western coast. But that too is part of the picture that has been coming into sharper focus over 12 years of the Grace satellite record. Countries at northern latitudes and in the tropics are getting wetter. But those countries at mid-latitude are running increasingly low on water. "What we see is very much a picture of the wet areas of the Earth getting wetter," Famiglietti said. "Those would be the high latitudes like the Arctic and the lower latitudes like the tropics. The middle latitudes in between, those are already the arid and semi-arid parts of the world and they are getting drier." On the satellite images the biggest losses were denoted by red hotspots, he said. And those red spots largely matched the locations of groundwater reserves. "Almost all of those red hotspots correspond to major aquifers of the world. What Grace shows us is that groundwater depletion is happening at a very rapid rate in almost all of the major aquifers in the arid and semi-arid parts of the world." The Middle East, north Africa and south Asia are all projected to experience water shortages over the coming years because of decades of bad management and overuse. Watering crops, slaking thirst in expanding cities, cooling power plants, fracking oil and gas wells – all take water from the same diminishing supply. Add to that climate change – which is projected to intensify dry spells in the coming years – and the world is going to be forced to think a lot more about water than it ever did before. The losses of water reserves are staggering. In seven years, beginning in 2003, parts of Turkey, Syria, Iraq and Iran along the Tigris and Euphrates rivers lost 144 cubic kilometres of stored freshwater – or about the same amount of water in the Dead Sea, according to data compiled by the Grace mission and released last year. A small portion of the water loss was due to soil drying up because of a 2007 drought and to a poor snowpack. Another share was lost to evaporation from lakes and reservoirs. But the majority of the water lost, 90km3, or about 60%, was due to reductions in groundwater. Farmers, facing drought, resorted to pumping out groundwater – at times on a massive scale. The Iraqi government drilled about 1,000 wells to weather the 2007 drought, all drawing from the same stressed supply. In south Asia, the losses of groundwater over the last decade were even higher. About 600 million people live on the 2,000km swath that extends from eastern Pakistan, across the hot dry plains of northern India and into Bangladesh, and the land is the most intensely irrigated in the world. Up to 75% of farmers rely on pumped groundwater to water their crops, and water use is intensifying. Over the last decade, groundwater was pumped out 70% faster than in the 1990s. Satellite measurements showed a staggering loss of 54km3 of groundwater a year. Indian farmers were pumping their way into a water crisis. The US security establishment is already warning of potential conflicts – including terror attacks – over water. In a 2012 report, the US director of national intelligence warned that overuse of water – as in India and other countries – was a source of conflict that could potentially compromise US national security. The report focused on water basins critical to the US security regime – the Nile, Tigris-Euphrates, Mekong, Jordan, Indus, Brahmaputra and Amu Darya. It concluded: "During the next 10 years, many countries important to the United States will experience water problems – shortages, poor water quality, or floods – that will risk instability and state failure, increase regional tensions, and distract them from working with the United States." Water, on its own, was unlikely to bring down governments. But the report warned that shortages could threaten food production and energy supply and put additional stress on governments struggling with poverty and social tensions. Some of those tensions are already apparent on the ground. The Pacific Institute, which studies issues of water and global security, found a fourfold increase in violent confrontations over water over the last decade. "I think the risk of conflicts over water is growing – not shrinking – because of increased competition, because of bad management and, ultimately, because of the impacts of climate change," said Peter Gleick, president of the Pacific Institute. There are dozens of potential flashpoints, spanning the globe. In the Middle East, Iranian officials are making contingency plans for water rationing in the greater Tehran area, home to 22 million people. Egypt has demanded Ethiopia stop construction of a mega-dam on the Nile, vowing to protect its historical rights to the river at "any cost". The Egyptian authorities have called for a study into whether the project would reduce the river's flow. Jordan, which has the third lowest reserves in the region, is struggling with an influx of Syrian refugees. The country is undergoing power cuts because of water shortages. Last week, Prince Hassan, the uncle of King Abdullah, warned that a war over water and energy could be even bloodier than the Arab spring. The United Arab Emirates, faced with a growing population, has invested in desalination projects and is harvesting rainwater. At an international water conference in Abu Dhabi last year, Crown Prince General Sheikh Mohammed bin Zayed al-Nahyan said: "For us, water is [now] more important than oil." The chances of countries going to war over water were slim – at least over the next decade, the national intelligence report said. But it warned ominously: "As water shortages become more acute beyond the next 10 years, water in shared basins will increasingly be used as leverage; the use of water as a weapon or to further terrorist objectives will become more likely beyond 10 years." Gleick predicted such conflicts would take other trajectories. He expected water tensions would erupt on a more local scale. "I think the biggest worry today is sub-national conflicts – conflicts between farmers and cities, between ethnic groups, between pastoralists and farmers in Africa, between upstream users and downstream users on the same river," said Gleick. "We have more tools at the international level to resolve disputes between nations. We have diplomats. We have treaties. We have international organisations that reduce the risk that India and Pakistan will go to war over water but we have far fewer tools at the sub-national level." And new fault lines are emerging with energy production. America's oil and gas rush is putting growing demands on a water supply already under pressure from drought and growing populations. More than half the nearly 40,000 wells drilled since 2011 were in drought-stricken areas, a report from the Ceres green investment network found last week. About 36% of those wells were in areas already experiencing groundwater depletion. How governments manage those water problems – and protect their groundwater reserves – will be critical. When California emerged from its last prolonged dry spell, in 2010, the Sacramento and San Joaquin river basins were badly depleted. The two river basins lost 10km3 of freshwater each year in 2012 and 2013, dropping the total volume of snow, surface water, soil moisture and groundwater to the lowest levels in nearly a decade. Without rain, those reservoirs are projected to drop even further during this drought. State officials are already preparing to drill additional wells to draw on groundwater. Famiglietti said that would be a mistake. "We are standing on a cliff looking over the edge and we have to decide what we are going to do," he said. "Are we just going to plunge into this next epic drought and tremendous, never-before-seen rates of groundwater depletion, or are we going to buckle down and start thinking of managing critical reserve for the long term? We are standing on a precipice here." REGIONS AT RISK 1 CALIFORNIA The state's water resources are at critically low levels and a drought emergency has been declared. The health department says 17 rural areas are dangerously parched. 2 BRAZIL São Paulo, the country's largest city, is on the verge of water rationing because of a severe drought and shortages are possible when the country hosts the football World Cup in the summer. January was the hottest month on record in the city and water in its main reservoir has fallen to 20.9% of its capacity, the lowest level in a decade. 3 MIDDLE EAST Tehran, the capital of Iran, is facing a shortage so serious that officials are making contingency plans for rationing in an area where 22 million live as well as in other big cities. President Hassan Rouhani has identified water as a national security issue. Shortages are so severe in the United Arab Emirates that the country is using non-conventional resources, including desalination, treated wastewater, rainwater harvesting and cloud seeding. At a a water conference,Crown Prince General Sheikh Mohammed bin Zayed al-Nahyan said: "For us, water is [now] more important than oil." With the third lowest water reserves in the region, Jordan is struggling to cope with an influx of Syrian refugees. The country is undergoing power cuts because of water shortages. Prince Hassan, uncle of King Abdullah, warned last week that a war over water and energy could be bloodier than the Arab spring. 4 NORTH AFRICA Egypt has demanded that Ethiopia stop construction of a mega-dam on the Nile, vowing to protect its historical rights to the river at "any cost". The Egyptian authorities have called for a study into whether the project would reduce the river's flow. 5 SOUTH ASIA About 600 million people live on the 2,000km swath that extends from eastern Pakistan, across the hot dry plains of northern India and into Bangladesh and the land is the world's most intensely irrigated. Up to 75% of farmers rely on pumped groundwater. 6 CHINA There is increasing competition for water. More than half the proposed coal-fired power stations are expected to be built in areas of high water stress, thus threatening water insecurity for farms, other industry and the public.

### Offshore key

#### Offshore nuclear power plants key to desalination, conventional methods fail

Michael Kanellos 07, Staff Writer at CNET specializing in technology, “A new source of water: Floating nuclear power plants,” 11-21-07, http://www.cnet.com/news/a-new-source-of-water-floating-nuclear-power-plants/.

Channel the heat from power plants to give water to a thristy world. That's the idea of a physicist from the Sont Longowal Institute in Punjab, India. Nuclear power plants have a lot of excess heat, so why not use that heat to make fresh water? That's the idea of S.S. Verma, with the Department of Physics at the Sont Longowal Institute in Punjab, India. If located offshore near large population centers, the plants could provide cheap electricity as well as fresh water to megacities like Mumbai.¶ Some companies are already looking at developing desalination platforms that can be attached to nuclear plants, he said, according to the Indo-Asian News Service (via Earthtimes). (Verma's complete paper can be found here.)¶ The general and very serious concerns about nuclear power--what do you do about transportation of nuclear materials? Disposal and storage? Safety?--of course apply. But it's also an interesting idea. Nuclear plants do produce a lot of waste heat. Many believe that hydrogen could become economical if the waste heat from these plants could be used to crack water molecules to produce the gas.¶ Some companies in Canada are contemplating installing nuclear power plants near the tar sands deposits in Alberta to produce hydrogen, a necessary ingredient for turning the goopy tar into usable liquid fuel.¶ The world is mired in a water crisis. In many large cities in India, people wait in line to get water from roving trucks. Droughts and crop failures are expected to increase as global temperatures rise. And it's not just in the emerging world. Australia is suffering through a prolonged shortage of water.¶ Desalination provides an avenue out of it, but conventional methods are expensive and somewhat time consuming

#### Offshore SMRs are key for desalination

Nolan Hertel 07, Nuclear and Radiological Engineer Professor at Georgia Tech, Ph.D., University of Illinois at Urbana-Champaign, Member of U. S. Department of Energy Joint Senior Review Group, Chair at Department of Energy U. S. Scientific Review Group, Co-Chair of International Commission on Radiation Units and Measurements, American Society for Engineering Education-2004 Nuclear Engineering Division Glenn Murphy Award, 12/26/07, “Why sweat? Tap nuclear power [for desalination],” Free Republic, http://www.freerepublic.com/focus/f-news/1945018/posts.

State governments looking for ways to cope with severe drought in the Southeast should consider using nuclear power to desalinate seawater. This is a safe and proven technology that the U.S. Navy has been using for more than a half-century to provide drinking water for the crews of its nuclear-powered submarines.¶ Until a few years ago, the water debate here in Georgia was conducted in an almost surreal atmosphere. We appeared to have sufficient supplies of water to meet our needs, and most of us seemed to feel that this state of affairs would continue indefinitely. By definition, miracles do not often happen, and it is not likely that the water problem will be solved by a miracle. The solution, if there is one, will be found in the development of comprehensive water use plans, strict conservation and technology. No one of these alone will solve our water problems, but all of them together have a good chance of succeeding.¶ The discrepancy between the need for water and its availability is seen not only in the difficulty of allocating scarce resources for households, industries, farms, electricity production, wildlife and recreation but also sharing common supplies with neighboring states. As our water resources diminish, it is becoming clear that unless we can come up with substitute sources of water, we will simply have less water and a lower standard of living.¶ Experience shows that nuclear reactors can be used to heat seawater in a process known as "reverse osmosis" to produce large amounts of potable water. The process is already in use in a number of places around the world, from India to Japan and Russia. Eight nuclear reactors coupled to desalination plants are operating in Japan alone.¶ Seawater desalination raises absolutely no technical problems. The technologies have been used for many years. But most of the world's 12,500 desalination plants use fossil fuels to provide the large amounts of energy needed to desalinate seawater, and that poses economic problems due to the rising cost of oil and natural gas and environmental problems from greenhouse-gas emissions. Nuclear power, on the other hand, is now economically competitive with fossil fuels and produces no greenhouse gases. It is a viable alternative for desalination.¶ Nuclear reactors could serve a dual purpose, providing both power and fresh water, as they do in nuclear submarines. If anchored a few miles offshore, nuclear desalination plants could be a source of large amounts of potable water transported by pipelines hundreds of miles inland to serve the needs of communities and industries.¶ A study completed by Argonne National Laboratory determined that dual-purpose reactors — called cogeneration plants — "could offer a major portion" of the additional water and electricity that municipalities and industry will need for maintaining sustainable development and growth in the years ahead. The study determined that nuclear power would be less costly as a heat source for water desalination than fossil-fuel plants using oil or natural gas. But it said that costs could vary according to the type of reactor used and its specific location, among other factors, requiring further economic analysis.¶ The next big step needs to be taken by the Department of Energy. It should propose construction of a demonstration reactor for desalination.¶ Production of large amounts of fresh water would alleviate water shortages in the decades ahead with attendant benefits to homeowners and businesses as well as the environment. Now is the time for the Department of Energy, in concert with Georgia and other states, to determine how best to proceed with nuclear desalination.

### 2NC – U – Yes Nuclear

#### Renewable desal now

Peng 10 [Jennie Peng, "MARKET REPORT: DEVELOPING DESALINATION IN CHINA," Water and Wastewater International, 2010] AZ

The central government is encouraging the development of renewable energy projects (wind-powered/nuclear-powered plants, etc.), in which desalination can be adopted as auxiliary water supply and treatment system. This is to use either the abundant power or heat to generate desalinated water and integrate the energy and water recycling system. Desalination can then benefit from the special fund allocated to renewable energy industry by the Chinese government. Though detailed policies for the desalination industry are yet to be confirmed for the 12th five year plan (2011-2015), it can be expected that favorable policies will become clear and will be translated into city-level goals with regulations on both privatisation and long-term risk proof.

#### China's doing it

NEI 16 [Nuclear Energy Institute, "Desalination," 2016] AZ

Nuclear Desalination Is Not New Several countries have implemented nuclear desalination, including India, Japan and Kazakhstan. The latter operated a 750 megawatt thermal facility for over a quarter century, generating not only desalinated water, but process heat and electricity as well. Nuclear-energy-powered water desalination is a well-understood technology, with thousands of man-hours behind it. Small Nuclear Reactors and Desalination: Perfect Together More recently, Argentina, China and South Korea have developed small nuclear reactor designs specifically to generate both electricity and fresh water. These run from 5 to 330 megawatts thermal. Russia has designed a barge-like floating nuclear facility, operating at 80 megawatts thermal. Small reactor technology may be key to expanding clean, nuclear energy-based desalination. Though nuclear energy has not displaced fossil fuels in water desalination projects, it has emerged from the background in the last several years, especially as climate change has become an important concern and small reactor technology has matured.

### 2NR – Overview

#### it's faster – water shortages guarantee war by 2030 since they won't be able to meet 25% of domestic demand in 10 years

### 2NR – Cost Effective

#### it's already cost-effective in china

Avrin 15 [Anne-Perrine Avrin, Gang He, Daniel M. Kammen, "Assessing the impacts of nuclear desalination and geoengineering to address China's water shortages," Desalination, 2015] AZ

In 2013, the minimum monthly wage in Beijing in January 2013 is $229 [41], that is $2748 per year. The average annual wage increase in China is considered to be 14.3% according to the trend of the last ten years [42]. Therefore, the five-percent rule will confirm the relevance of nuclear desalination only if the production and supply cost of 500 m3 of water per person per year in 2030 in Beijing is below $1703. As of 2013, renewable water resource in Beijing is 145 m3 /capita/ annum [25]. Beijing's population in 2013 is 20.7 billion, and in 2030 it will be about 30 million. In a “business-as-usual” scenario, the renewable water resource per capita per annum in 2030 will therefore be 100 m3 per year. This section of the study aims at evaluating the economic impact of supplying an additional 400 m3 of water per capita per year in Beijing, using nuclear desalination, in order to reach the 500-m3 absolute scarcity threshold for households. This represents an additional supply of four times that of a “business-as-usual” scenario. The costs of water production and supply from Chinese desalination plants to Beijing in 2030 (Fig. 3) depend on the quantity of supply per person per day. Supplying each of the 30 million inhabitants of Beijing with 400 m3 of water per year from desalination means a quantity of water of 1.1 m3 per day. According to Fig. 3, the average cost of supplying 1.1 m3 per person per day to Beijing in 2030 is $1.18/m3 . The cost of producing and supplying 500 m3 of water per year per capita in Beijing, including 400 m3 from desalination with an average cost of $1.18/m3 , will cost to each Beijing's inhabitant $630 annually. This amount equals about 1.85% of the minimum annual salary in Beijing, which is affordable according to the fivepercent rule. The same cost simulation was performed to eradicate absolute scarcity in the capitals of the nine other water-scarce provinces; results are presented in Table 2. The total additional water supply to eradicate absolute scarcity in these cities, hosting 0.16 billion inhabitants in total, is 134 million m3 per year, which is less than 0.6% of the total quantity of fresh water that will be available through nuclear desalination by 2030. Calculations show that eradicating water scarcity through nuclear desalination in these ten capitals at risk will be affordable for every Chinese household by 2030 according to the five-percent rule. The fivepercent rule also shows that water tariffs by 2030 in all water-scarce capitals could be increased well above inflation's sole effect without jeopardizing Chinese households' ability to afford water. In case of pure water needs – for special industries for example – water production cost in 2013 will be around $5/m3 due to treatment. Because MED produces pure water, nuclear desalination costs are already below water market price in China [24].